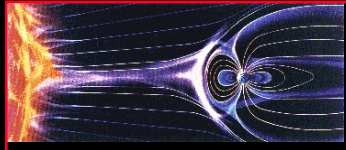
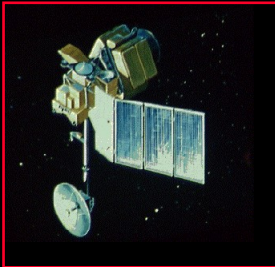


Briefing Topics

INTRODUCTION



REMOTE EARTH SENSING



COMMUNICATIONS



NAVIGATION

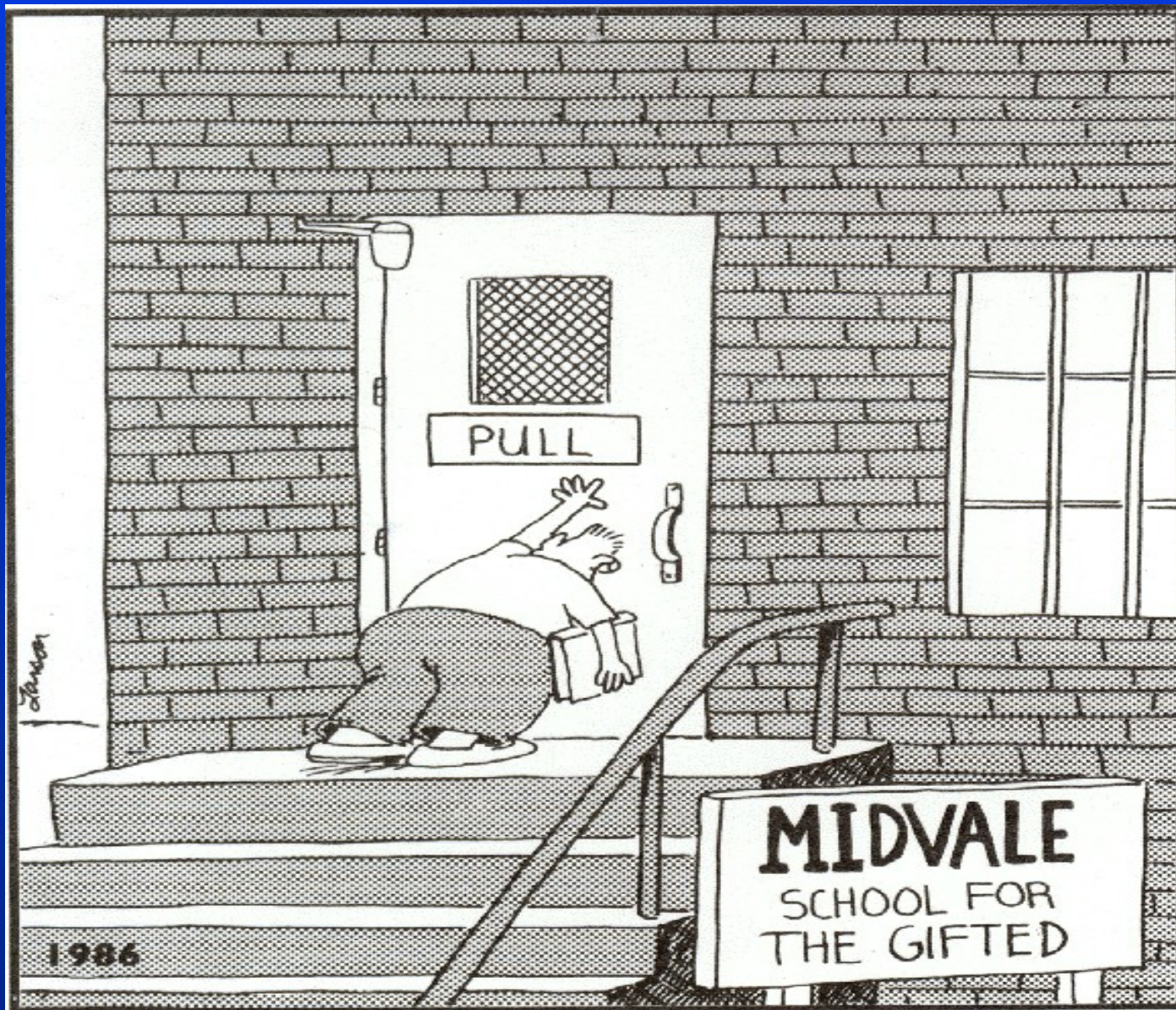


WARNING



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Space 101



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Satellite Components

Bus

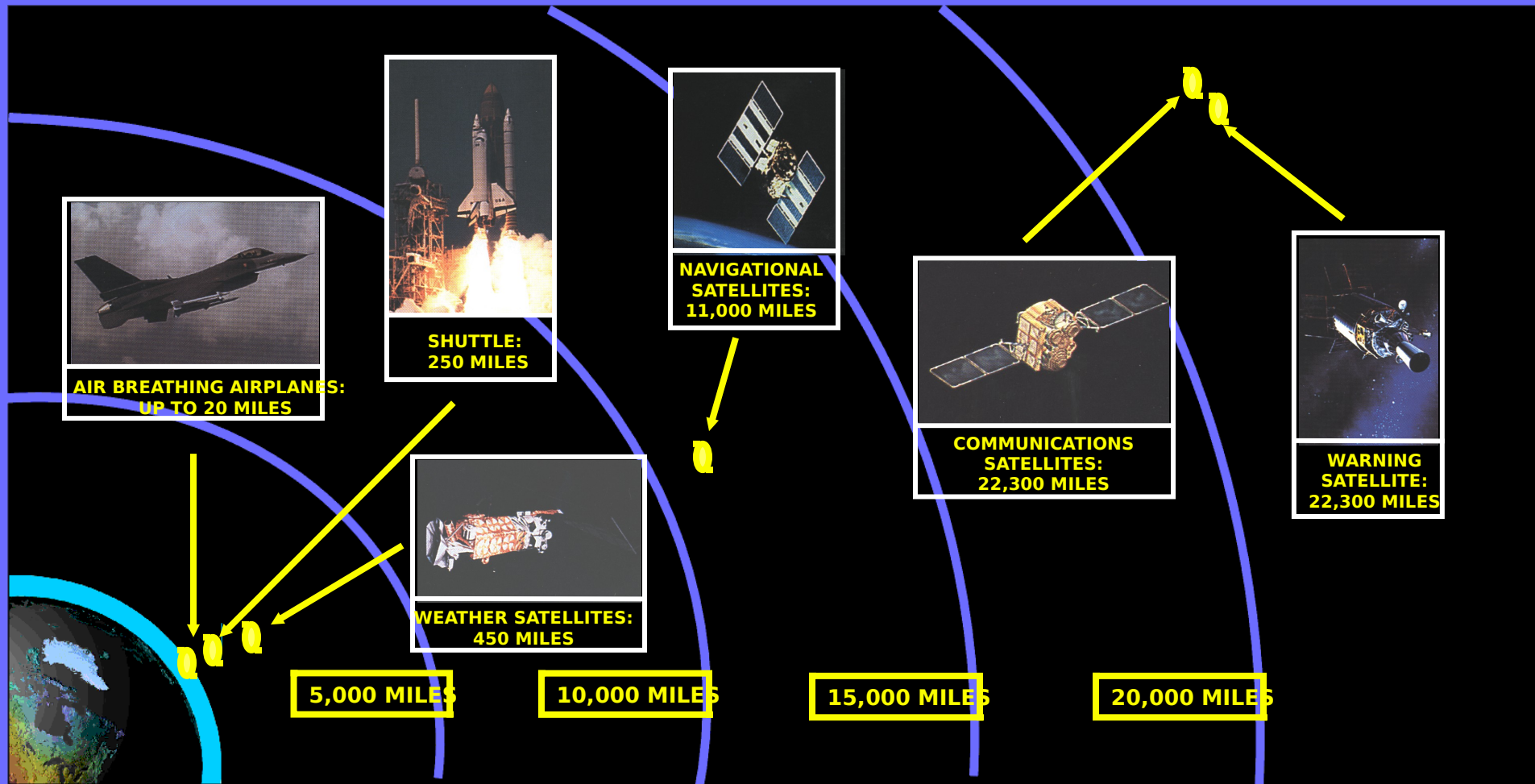
**Mission
Payload**



**Power
Supply**

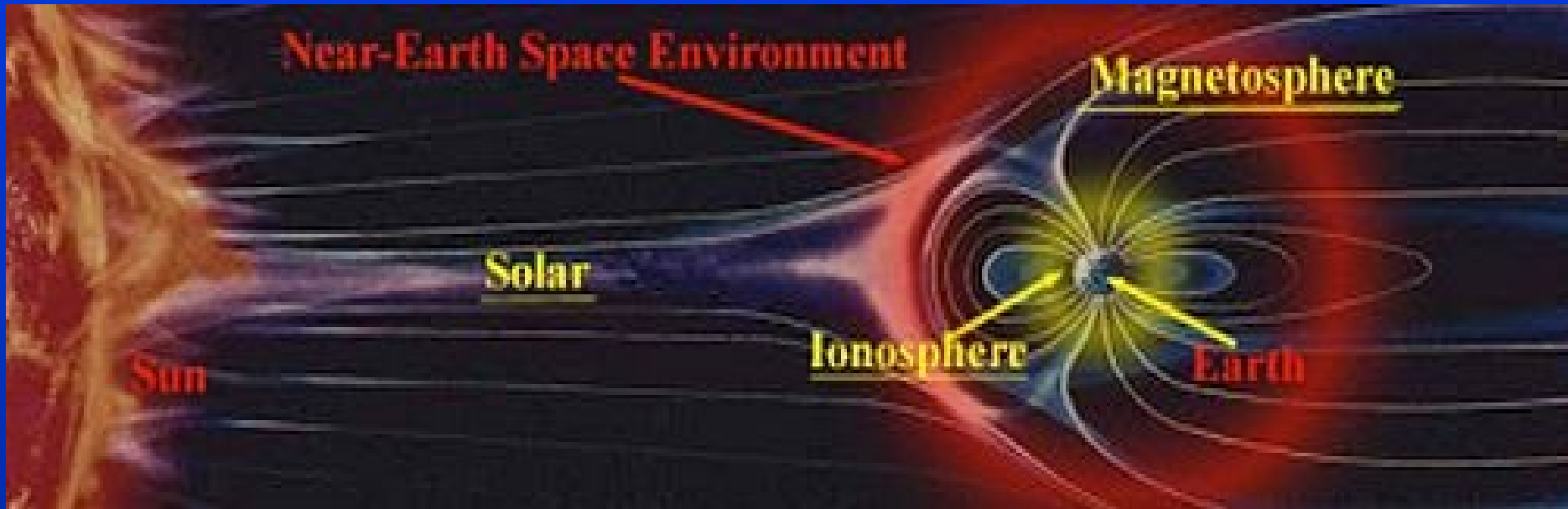
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Orbitology



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Space Environment



Introduction Takeaways

- **Different orbits support different missions and functions.**
- **Space weather is an important consideration to all users of space-based assets. Ability exists to predict tactical impacts.**

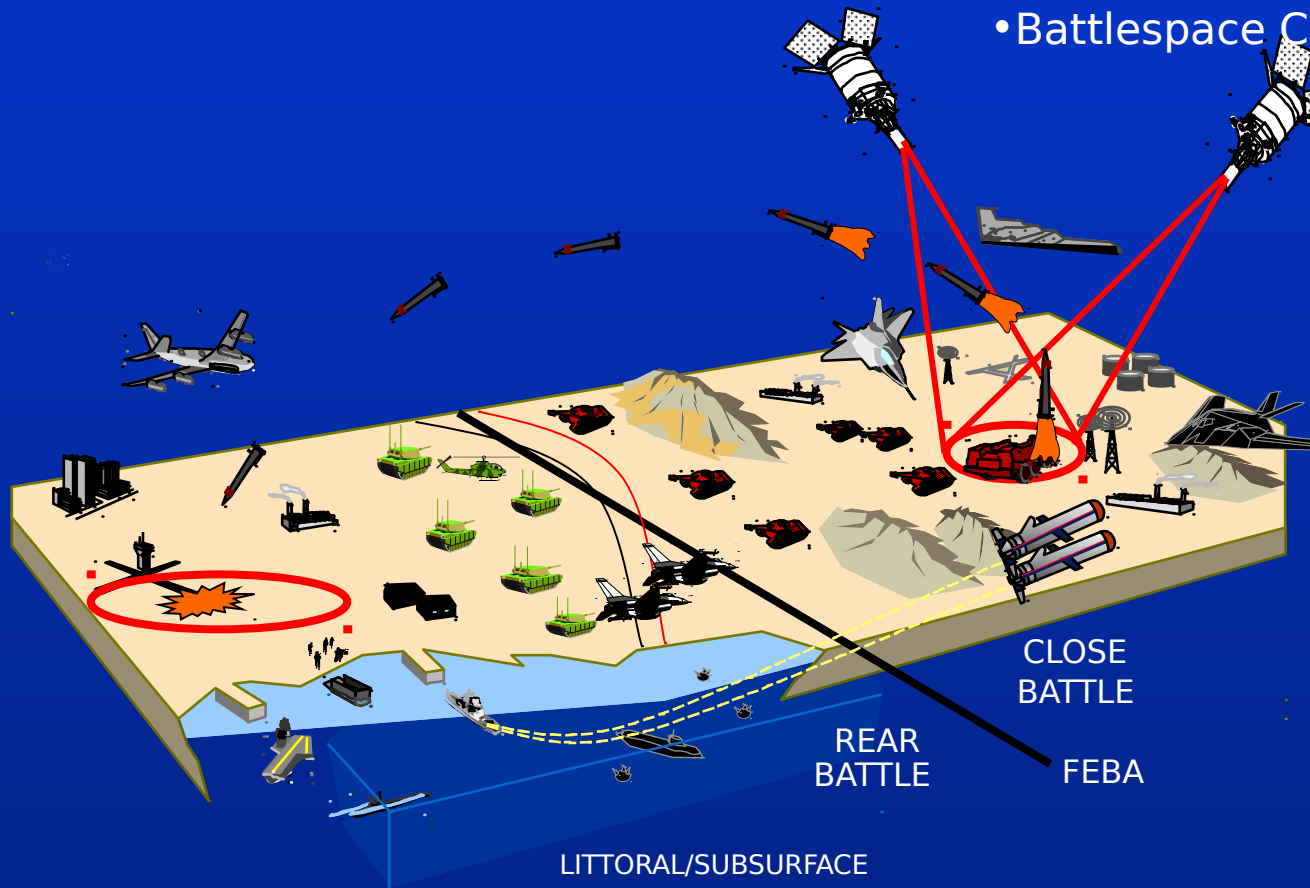
Force Enhancement: Warning

- **Defense Support Program:**

- Worldwide Infrared Surveillance
- Strategic and Tactical

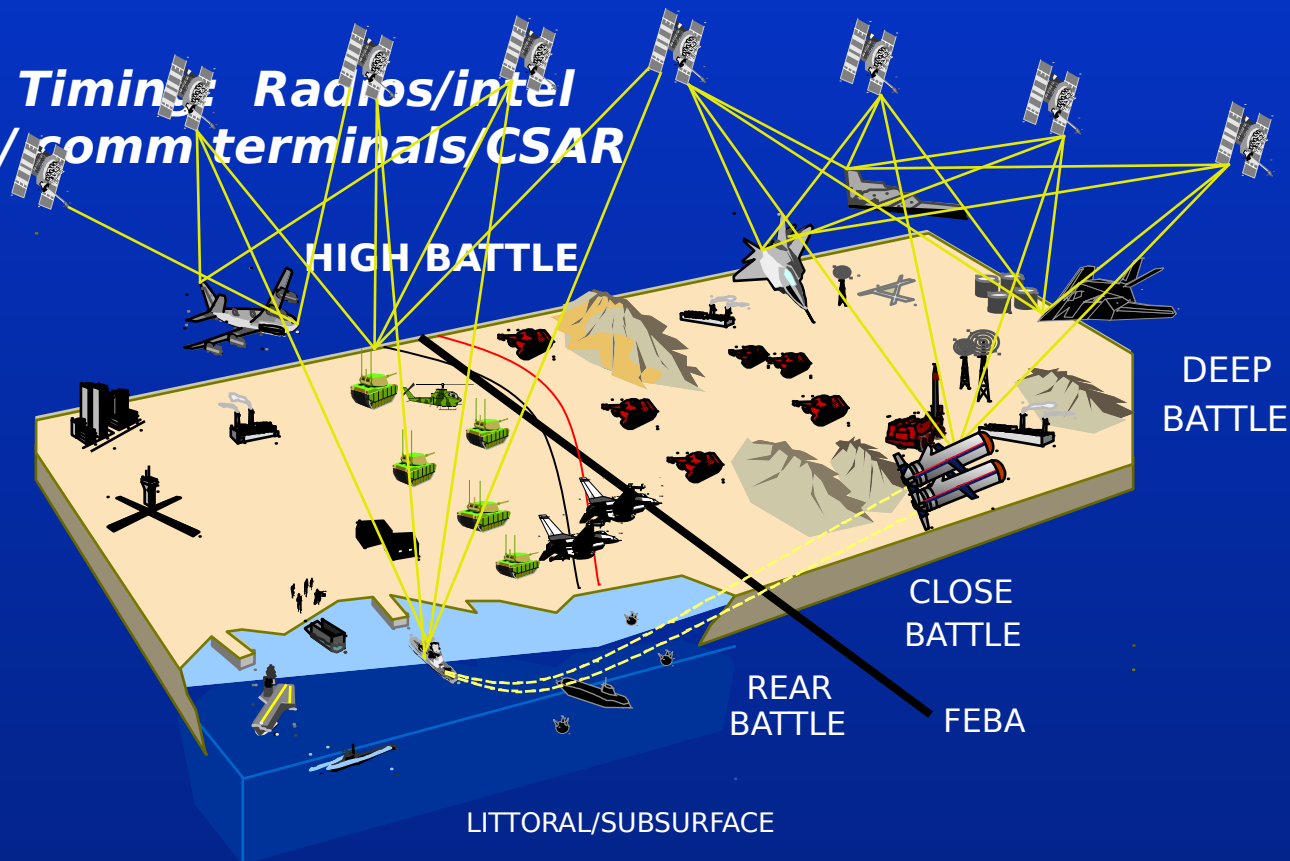
- **Space-Based InfraRed System (SBIRS):**

- Worldwide Infrared Surveillance
- Strategic and Tactical Warning
- Technical Intelligence
- Battlespace Characterization



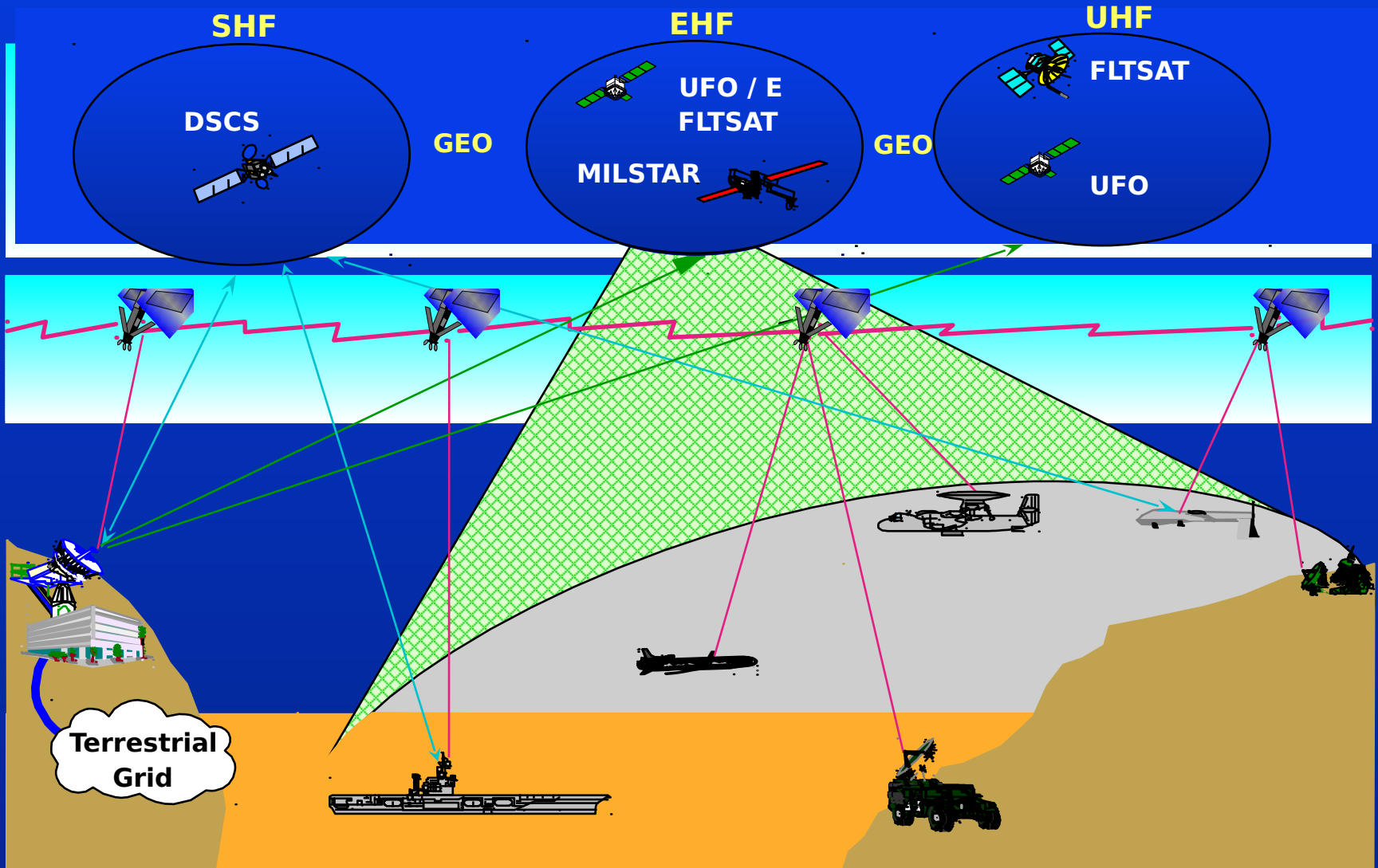
Force Enhancement: Navigation

- **Global Positioning System:**
 - **Required:** 16m Nav 28ns Timing
 - **Actual:** 3-7m Nav 6ns Timing
 - **Navigation:** need 4 visible for 3D fix
 - **Precise Timing:** Radios/intel systems/comm terminals/CSAR



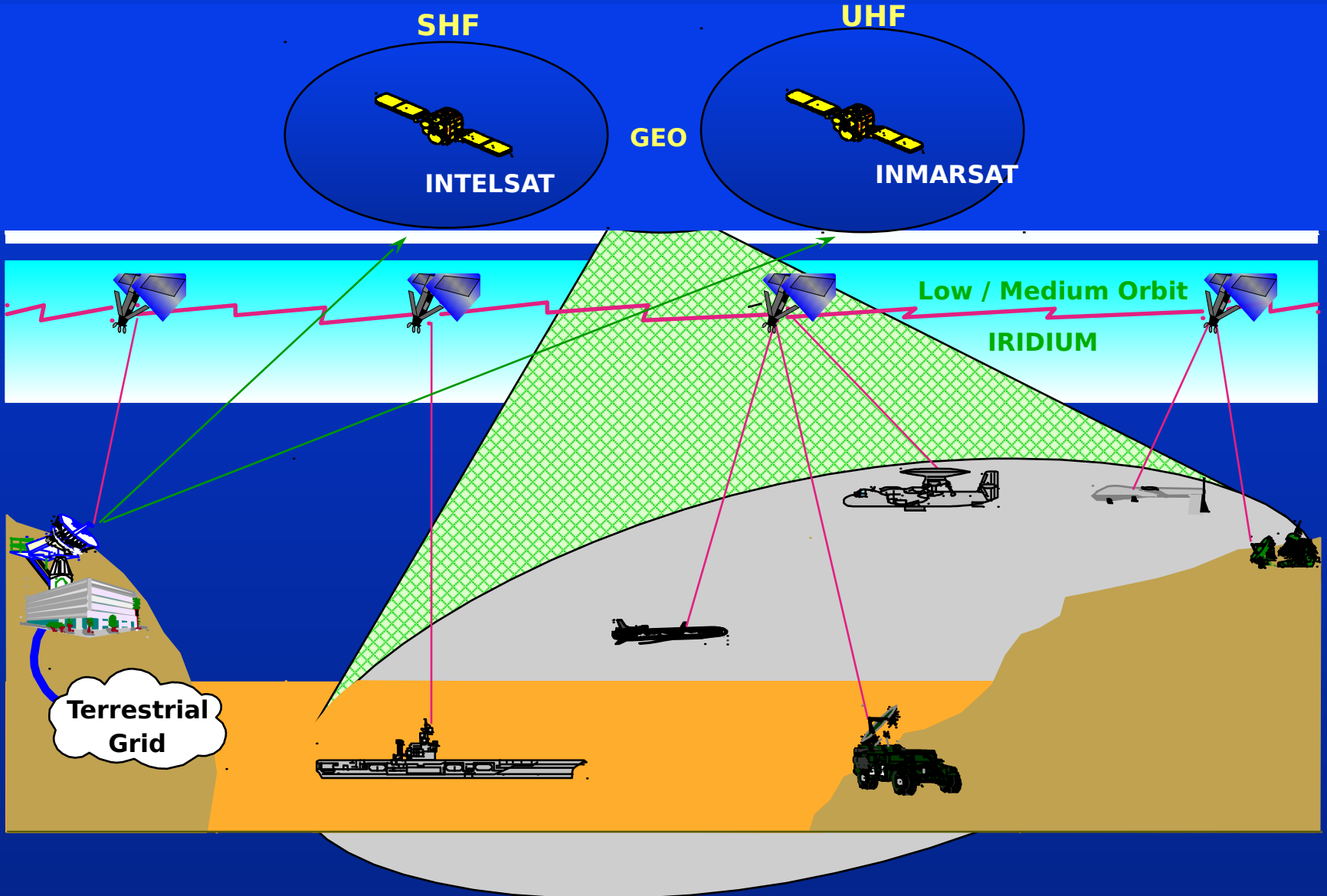
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DoD SATELLITE COMMUNICATIONS SYSTEMS

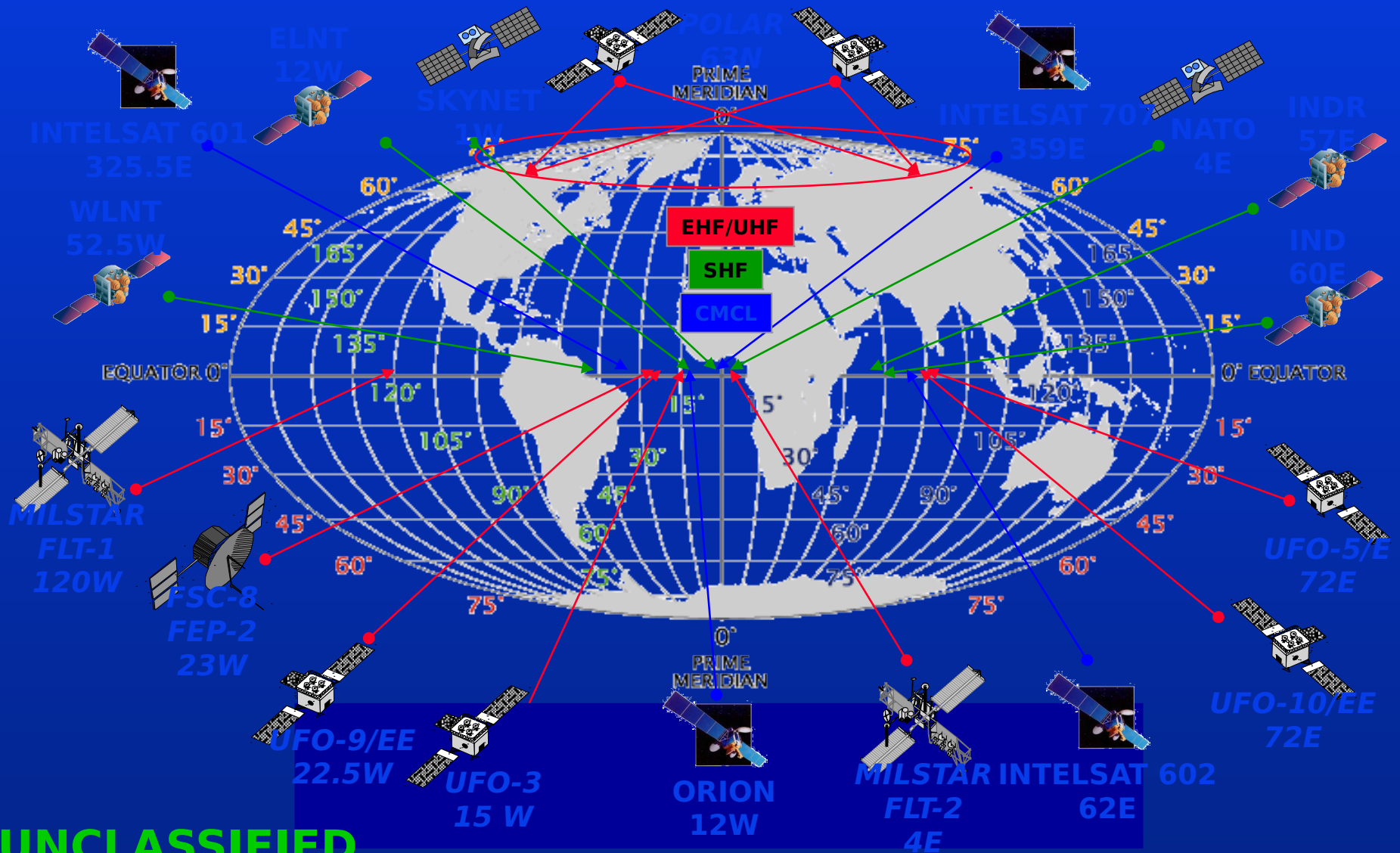


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COMMERCIAL SATELLITE COMMUNICATIONS SYSTEMS



Example: Satellite Comm Dependency



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Communications Jamming Threat

Jamming
Difficulty

Band

Jamming
Effectiveness

Easiest

Highest

UHF

- Low Cost
- Lightweight
- Off-the-Shelf Technology

SHF

- Moderate Cost
- Larger Unit
- Requires Sophisticated Technology

EHF

- High Cost
- Very Large Terminal
- Requires Highly Sophisticated Technology

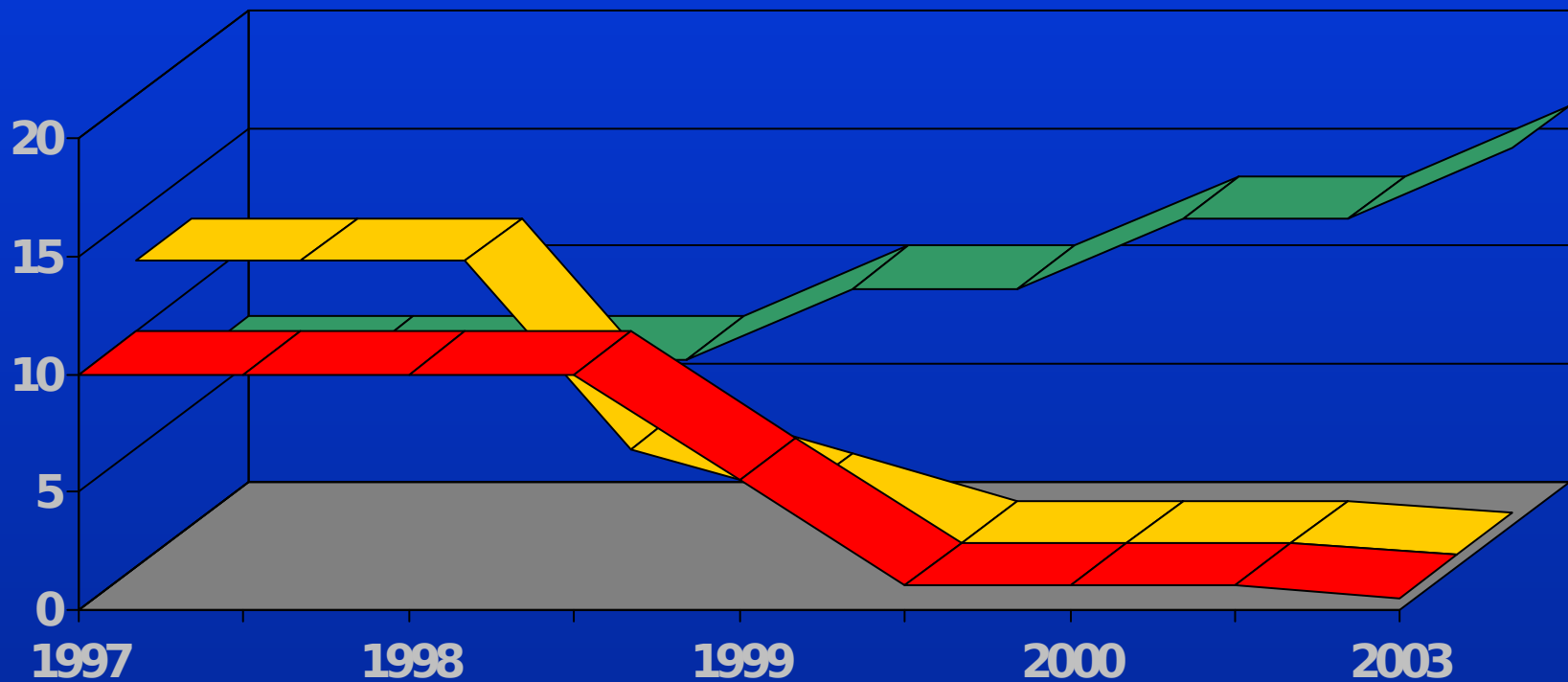
Hardest

Lowest

Example: Rest-of-World Space OB



Commercial Imagery Trends



Satellite Imagery



28 Dec 2000



12 Sep 2001

This one-meter resolution satellite image was taken by Space Imaging's IKONOS satellite. IKONOS travels 423 miles above the Earth's surface at a speed of 17,500 miles per hour.

Defensive Counterspace

- **Current defensive counterspace measures limited to:**
 - **Satellite hardening & redundancy**
 - **Mobile, deployable ground links**



Improving our defensive counterspace capabilities is paramount as adversaries continue to develop and deploy means to counter our space capabilities

Offensive Counterspace

“Offensive counterspace operations destroy or neutralize an adversary’s space systems or the information they provide at a time and place of our choosing...”

- AFDD-1

Potential Methods:

Uplink Jamming

Downlink Jamming

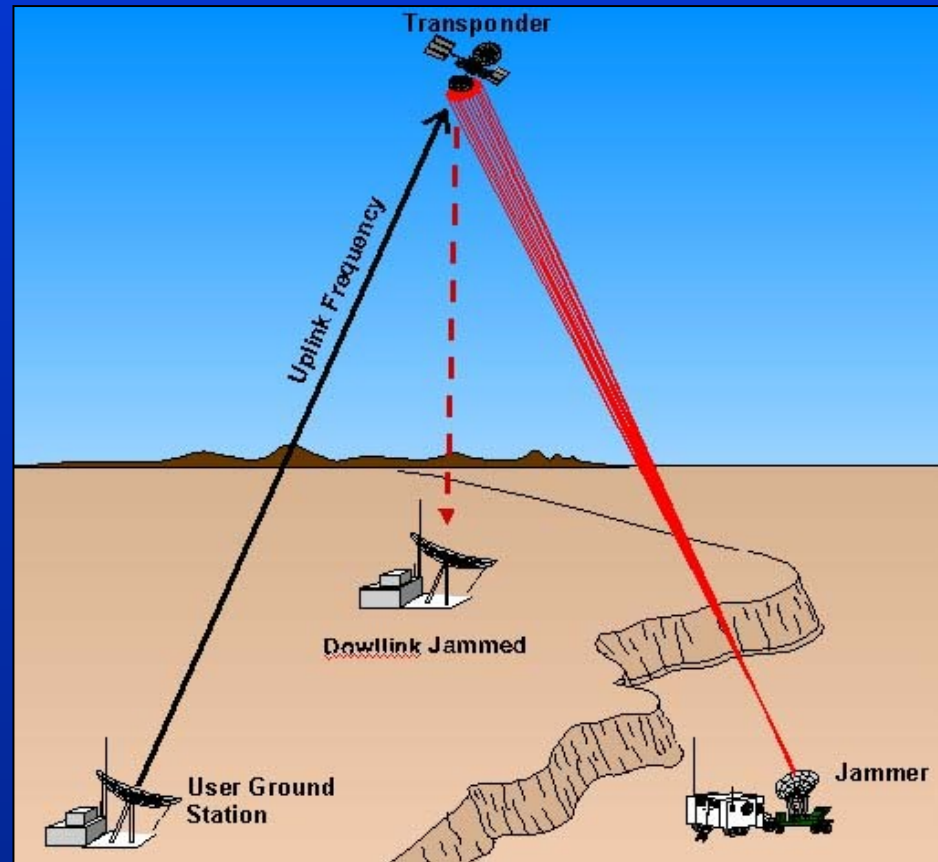
Laser Blinding

Kinetic attack

Uplink Jamming

**Deny usefulness of
downlink data to all users**

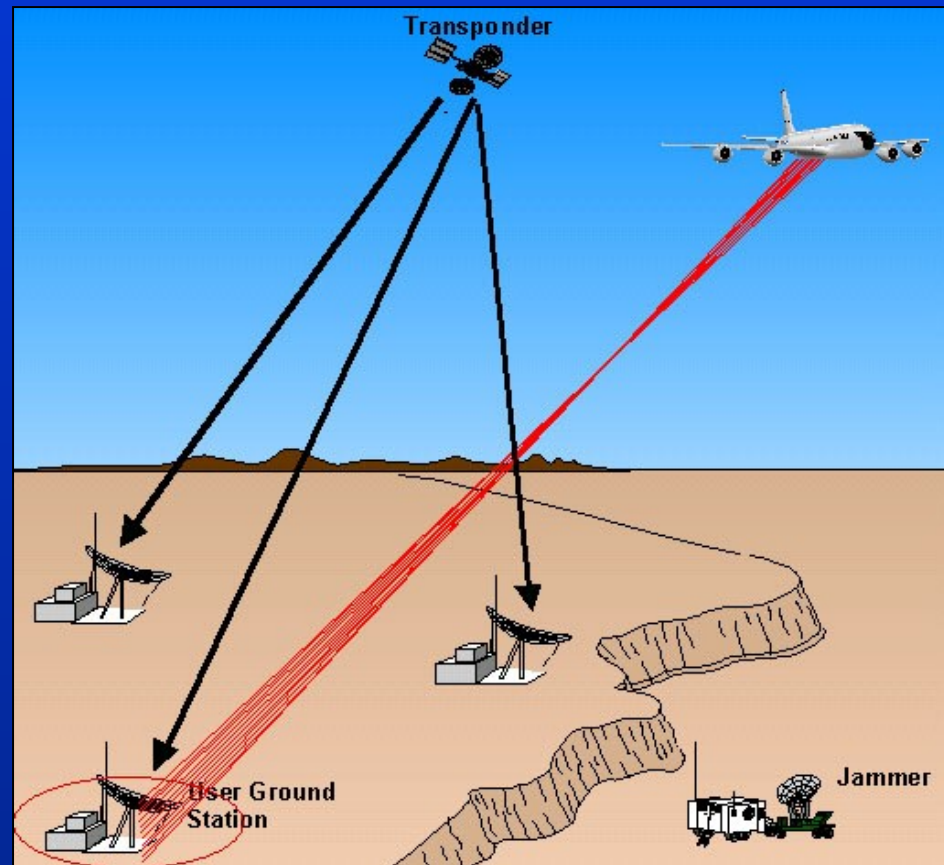
- **Attack satellite transponder directly (saturation)**
- **Corrupt data fed through to downlink**



Downlink Jamming

Deny usefulness of downlink data to select users

- **Attack ground station directly**
- **Deny information to select sites**



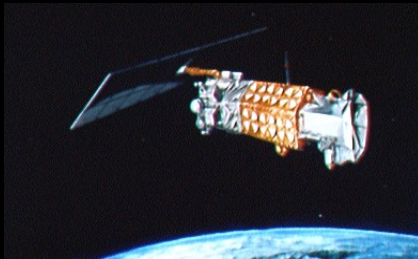
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Current Weather Systems



DMSP

- **LEO, 2 Satellite Constellation**
- **Encrypted Downlink**



TIROS-N

- **LEO, 2 Satellite Constellation**
- **Non-encrypted Downlink**

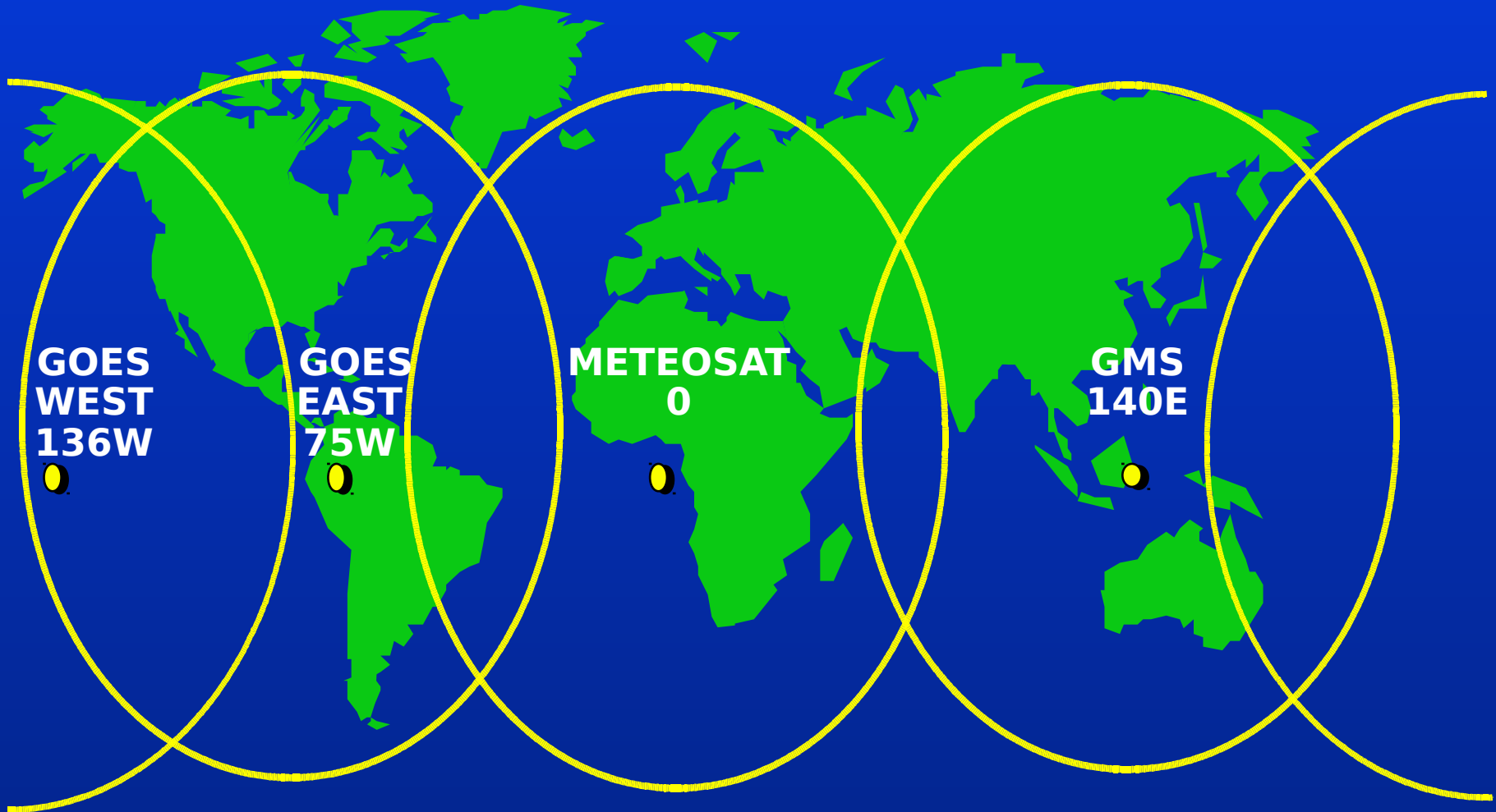


GOES

- **GEO, 2 Satellite Constellation**
- **Non-encrypted Downlink**

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World Weather Watch System



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Terrain Categorization

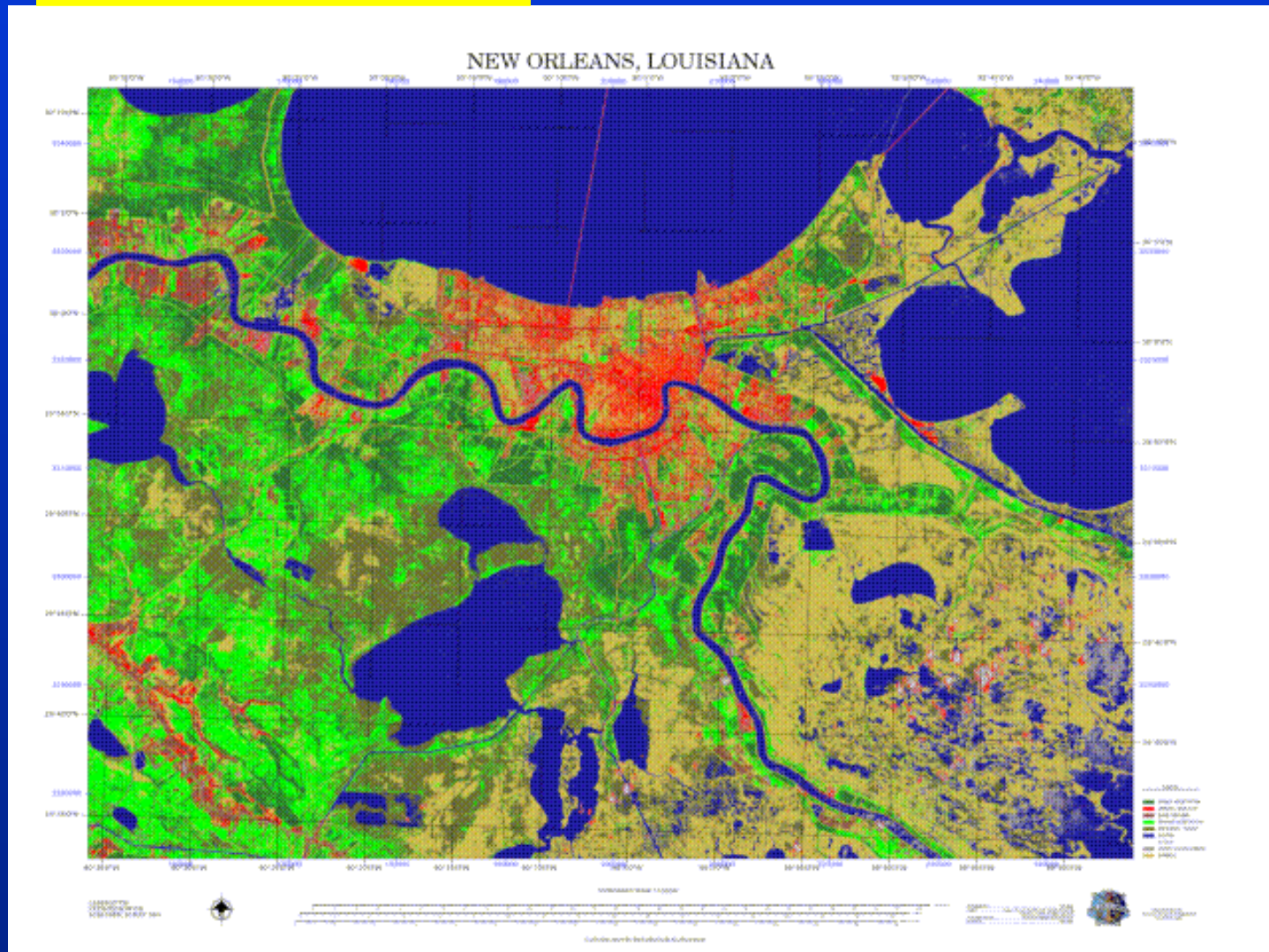
**Red=Urban
Areas**

**Brown=Bare
Earth**

Blue=Water

**Green=Heavy
Vegetation**

Light Green=Sparse Vegetation



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Bottom Line



**Reliable
Indication
&
Warning**



Joint Warfighting Superiority

Assured Comms



Precise Navigation

